

I Drink, You Drink, We ALL Drink WATER!

Brief Overview:

Data Analysis is a process used to gather information by asking formulated questions. Data analysis allows you to collect, organize, evaluate, and display your answers in a relevant form. Through various activities and games the opportunity to develop, engage, and apply real life experiences will create flexible, engaged math thinkers. The students will complete a taste test, complete surveys, and do experiments on water.

NCTM Content Standard/National Science Education Standard:

- 1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.**
 - Collect data using observations, surveys, and experiments**
 - Represent data using tables and graphs such as line plots, bar graphs, and line graphs.**
 - Design investigations to address a question.**

Grade/Level:

Grade 5

Duration/Length:

3 days (60 minutes a day)

Student Outcomes:

Students will:

- Collect, organize, and display data in a bar graph.**
- Collect, organize, and display data in a line plot.**
- Collect, organize, and display data on a pie chart**
- Interpret and compare results of a bar graph.**
- Interpret and compare results of a line plot.**
- Interpret and compare results of a pie chart.**

Materials and Resources:

- 5 different brands of bottled water (remove labels)
- Disposable cups
- Labels
- Markers
- Construction paper
- Plastic jugs/pitchers
- Large sheets of chart paper

Development/Procedures:

Lesson 1

Pre-Assessment

This lesson may be taught with the study of why water is important and its many uses. You can engage the students by asking them what they already know about water and how it is used (i.e. drinking, washing, recreation, etc.) Have students give examples of how they have used water in the past. Allow students a chance to compare how they have used water with other students in the class. Gather all of their information and encourage students to determine how this information can be displayed so it can be easily interpreted. Once you have a list of various ways to display data check for the following: bar graph, line plot, and pie chart (If these graphs are not suggested, review each type).

- Say: We will be studying how to collect, display, and interpret data using the theme, water. At the end of the 3-day lesson you will have collected information, distributed a survey, and completed an experiment about water. You will learn how and why water is important to your classmates, your family, and yourself.

Launch

Ask: "What's your favorite drink and why?" Launch into an explanation of the next three days. Say:

- Water is found in most of the drinks you named and even some foods. Explain that water can look the same and not have the same taste.
- Today, you will be a sales representative for a bottled water company. You will be broken up into groups of 5 and each group will have 4 to 5 members. Each group will be named after an ocean and represent a particular bottled water company. Only the representatives on each team will know for certain what water product they represent. Students can be given time to decorate their area of the classroom so that it represents their company's name (ocean) and some of the animals/plants found in that particular ocean.
- Make students aware that their data will be interpreted and displayed in the following forms: bar graph and pie chart. The winning company (ocean) will be allowed to complete the same survey with a different class of students and receive special recognition during the school assembly.
- Before the taste test begins each student must complete a survey about what brand of water they think they like the best (you can have the empty bottles with their labels so they can see the choices. Allow them to use past experiences about the brand they would normally drink) and compare it to the brand they chose during the actual taste test.

Extension:

Inform students that oceans cover about 70% of the Earth's surface and roughly 97% of the Earth's water supply. Oceans of Earth are unique in our Solar System. No other planet in our Solar System has liquid water (although recent finds on Mars indicate that Mars may have had some liquid water in recent

past). The oceans of Earth serve many functions, especially affecting the weather and temperature. The Earth's oceans are all connected to one another. There are 5 recognized oceans as of 2000: the Pacific, Atlantic, Indian, Arctic, and Southern Ocean (it surrounds Antarctica and extends to 60 degrees latitude). There are many seas (smaller branches of an ocean); seas are often partly enclosed by land. The largest seas are the South China Sea, the Caribbean, and the Mediterranean Sea.

Teacher Facilitation

Distribute 5 jugs of water labeled with an alphabet or number, 5 sheets of construction paper, and disposable cups (enough for each child to receive one), and a marker. Make sure the students label the jug and the construction paper with the same alphabet/number. Have each one of the team members sit behind a jug and be responsible for gathering the data from that particular jug of water. The students can keep a tally of whether or not the taster chose their specific type of water or not (Student Resource 1). Each student must participate in the taste test until everyone has had an opportunity to choose a brand of water. Each company (group/ocean) will evaluate the data they received from Student Resource 1 (taste test results) and organize the data in three forms: bar graph, and pie chart. Every team will use large sheets of graph paper to display their data in form of a bar graph and pie chart to be displayed in the classroom.

Student Application

Students will complete Student Resource 2 (Daily Investigation Evaluation), is a and Student Resource 3 (Do's and Don'ts - Ways to Keep Water Clean)

Embedded Assessment

Ask the students to compare their results with the other students' companies. Students are to check (may use calculators) the totals of each team and then determine who is the winner.

Reteaching/Extension

- For those who have not completely understood the lesson, review how to build a bar graph and pie chart. Also review Student Resource 1-4.
- For those who have understood the lesson, allow them to do Internet research about their ocean or another ocean that was discussed today (Student Resource 5 - Oceans on Earth), and color and/or decorate their water log cover sheet (Student Resource 6). For extra credit, have students make a poster, Power Point, or foldable book about the ocean they chose to research.

Lesson 2 MORE THAN ENOUGH???

Materials:

For each group of 2-3 students

- 60-70 pennies
- 2-3 Plastic cups
- 1 small pitcher of water
- 2-3 Aluminum pie pans

Pre-Assessment - Students should be familiar with double bar graphing for this lesson. You may want to give a brief review.

Launch

Key Questions:

1. Is it possible to fill a cup of water beyond its rim?
2. What is a "heaping" measure?

(They may recall seeing or hearing of recipes that call for a heaping teaspoon of salt or sugar.)

3. Is it possible to have a "heaping" glass of water?
4. What dessert is soft and has a thin skin on it?
(Possible answers should include cooked pudding.)
5. Present and discuss vocabulary words. Students should write words into their Logs, Student Resource 5
 - a. Surface tension
 - b. Heaping
 - c. Attraction
 - d. Molecule
 - e. Prediction
 - f. Actual

One of water's unusual properties is its strong "skin", or what scientists call surface tension. Through experimentation, student will observe surface tension, make predictions, enter actual data results into a double bar graph, analyze, and discuss this information.

Teacher Facilitation

Explain to students that they will try to fill a cup of water beyond its rim. Have students break into teams of 2-3 at a lab table. Jobs are chosen for Materials person, Motivator, and Recorder. Materials person collects items needed for experiment. Motivator keeps everyone on task and Recorder records the data onto the lab sheet, Student Resource 6.

Student Application

Have students place a cup in the pie pan. Students pour water into the cup until it is full to the rim. **(This is very important that they fill the water to the rim not below the rim)** At this time students should predict the amount of coins needed to make the water overflow, Student Resource 6. Tell each student to conduct a trial by putting one coin in at a time into the cup—they should be careful not to drop the coins from high above the water. Have students look across top of the cup after three or four coins have been added. They will see that the level of water has risen above

the top of the cup and has formed a rounded or "heaping" surface. After this phenomenon has been observed, students should continue to add coins to the water until the water spills. Have students count the number of coins that are in the cup. Group makes a table showing their collected data on the number of coins it took to break the skin of water in the cup, Student Resource 6. The group makes a double bar graph using different colors for actual and predicted data, Student Resource 7.

Closure

Key Questions: Why didn't the water spill out as soon as it reached the rim?

Teacher points out water molecules are attracted to each other, and that the attraction between the surface water molecules draw them very close together. This forms a skin like surface that keeps water together. The "skin" also helps to adhere the water to the rim of the cup. This makes it possible to build up water above the rim of the top of the cup. The skin will break when the weight of the water gets too heavy.

Embedded Assessment

- Students complete a double bar graph showing prediction and actual results using different colors
- Vocabulary - define and write complete sentences for each word.

Reteaching/Extension

- **Reteaching**—Have students retest putting coins in a cup. Use a hand magnifier to view the "skin" on the water.
- **Extension**—Students can explore by testing other liquids. Challenge them to discover which liquid "heaps" the highest.

Lesson 3

Materials - Group of 4 students

- 4 clear, wide mouth plastic cups
- 8 standard sized paper clips
- 1 pitcher of water

- 4 toothpicks
- Paper towels
- 10 ml liquid detergent
- Needle (optional)

Pre-assessment - Review surface tension

Teacher Demo - "Tightrope Walking Water"

Have a beaker of water (in left hand) and 1 meter of yarn between your two hands. Tilt right hand and place it directly above an empty beaker on the table. Water should run down yarn into the empty beaker. What you have shown is the water molecules attracting to the yarn. This is similar to surface tension created by the water molecules in Lesson 2.

Launch

Key Questions:

1. What weakens water surface tension? (movement, other liquids)
2. Can paper clips float on water? Why? (surface tension)
3. Review vocabulary presented in Lesson 2

Teacher Facilitation

Have students break into teams of 4 at a lab table. Jobs are chosen for Materials person, Motivator, Recorder and Speaker. Materials person collects items needed for experiment. Motivator keeps everyone on task and Recorder writes the data onto lab sheet and Speaker presents group findings to the class.

Student Application

Have students fill their cups three-quarters full of water. Tell them to bend one paper clip open so it forms a right angle. Then have them lay a second paper clip across the "lap" of the first

clip. Students should make sure the water is very still, and they should slowly and carefully lower the cradled paper clips onto the water. Slowly remove the clip cradle and the paper clip should be floating. Encourage the students to continue trying until they are successful. Wet paper clips should be dried on paper towel before attempting again.

Challenge students to try a needle.

When all the students have a paper clip or needle floating on the water, tell them to touch one end of a toothpick in the liquid detergent and then touch the surface of the water. The paper clip or needle will immediately sink. This occurs because the detergent weakens the surface tension of the water so the water is no longer able to hold up the paper clip or needle.

Embedded Assessment

Once students are successful they will want to help others. Encourage them to do so.

When all students have successfully floated 1 paper clip a competition can be started to see who can float the most clips in their cup. Students should display their data on a class line plot, Student Resource 9. Students will find the mean, median, and mode of a typical number of paper clips that float. Have students draw a picture of the lab in their student water log, Student Resource 5.

Reteaching/Extension

For those student unable to float the paper clip using the bent clip, have them use a plastic fork to cradle the paper clip as they place it on the water's surface. When they have been successful, tell students to look carefully at the surface of the water where the paperclip or needle rests. They will see that the floating object makes a slight indentation in the water's surface. Explain that water molecules cling together to form a surface that is strong enough to support a paper clip. This effect is called

surface tension. All liquids show surface tension, though its strength varies from one liquid to another.

Summative Assessment:

This is the completion of the lesson plan. Create an exciting way to expand what was taught. You may have the students make up a song or rap about the ocean they researched, write a poem/play about the ocean and/or facts about water. Students can also elaborate or explain what they learned about water, how water is a bargain and how to use it wisely. Students may also take a walk around the class and review what each group posted in the classroom.

Appendix A:

Teacher Resources

- **Teacher Resource 1 (Water is a Part of Everything)**
- **Teacher Resource 2 (Dos and Don'ts- Ways to Keep Water Clean)**

Appendix B:

Student Resources

- **Student Resource 1 (Taste Test Results Sheet)**
- **Student Resource 2 (Daily Investigation Evaluation)**
- **Student Resource 3 (Dos and Don't- Ways to Keep Water Clean)**
- **Student Resource 4 (Oceans on Earth)**
- **Student Resource 5 (Water log cover sheet)**
- **Student Resource 6 (More than Enough -Table)**
- **Student Resource 7 (More than Enough -Graph)**

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Water is a Part of Everything!

Answer Key

- 1. 6 gallons**
- 2. 1,300 gallons**
- 3. 150 gallons**
- 4. 100 gallons**
- 5. $6 + 1,300 + 150 + 100 = 1,556$ gallons of water**

Dos and Don'ts-Ways to Keep Water Clean



Answer Key

1. **DON'T** – Take short showers. If you take a bath or shower, limit your water.
2. **DO**
3. **DON'T** – Use other ways to make water cold, like adding ice or placing it in the refrigerator.
4. **DO**
5. **DO**
6. **DON'T** – Place hazardous materials in safe place; do not pour them down the sink.
7. **DON'T** – Just water the grass or plants around the roots so they can receive some hydration or moisture.
8. **DON'T** – Throw pollutants in the trash or designated area because cleaning solutions and batteries have lead and mercury in them, and can pollute groundwater.

DO

Taste Test Results Sheet



Directions: Tally the results of your data.

Kinds of Drink	Tally	Total
DRINK # 1		
DRINK # 2		
DRINK # 3		
DRINK # 4		
DRINK # 5		

Using the total tallies from above answer the following questions:

1. Which drink was selected the most number of times?

2. Which drink was selected the least number of times?

3. Find the difference between drink 1 and 5. _____
4. Find the difference between the drink selected the most and least.

5. Which drink was selected most by your team members?

Daily Investigation Evaluation

Name: _____

Date: _____



Investigation: _____



What we did: _____



What we saw: _____



What we learned: _____

Dos and Don'ts-Ways to Keep Water Clean



You can volunteer to pick up trash around a lake that is a source of drinking water. Such efforts are one way to keep our water clean.

Name: _____

Date:

Directions: Below are a number of ways you can keep water clean. Some of the ways are things you should do (true) and some are things you shouldn't do (false). For each blank write the word **DO** or **DON'T**. If the statement is a don't change the statement so that it is a Do.

_____ 1. Take long showers. If you take a bath or shower don't limit your water.

_____ 2. Report leaking faucets or toilets to your parents.

_____ 3. Run water to make it cold.

_____ 4. Report pollution.

_____ 5. Learn about the watershed you live in and work to keep it clean.

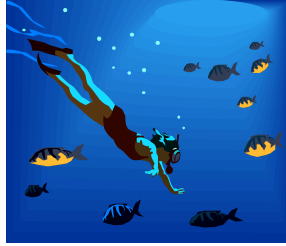
_____ 6. Pour pollutants such as cleaning products or paint down the drain.

_____ 7. Over water the grass in your yard or plants in the garden.

_____ 8. Throw cleaning solutions or old batteries in the nearest ocean, river, or stream.

_____ 9. Make a list of how you use water. Then make a list of how you could use less water.

Oceans on Earth



Name: _____ **Date:** _____

Directions: Use the Internet to research one of the five oceans of your choice.

Name of Ocean: _____

What continent(s) is it in close proximity of?

What kind of plant life is found in this ocean?

Name different animals found in this ocean?

Select one animal from your list above and give as many details about it as possible. (size, habitat, source of food, etc...)

Give the following information about your ocean:

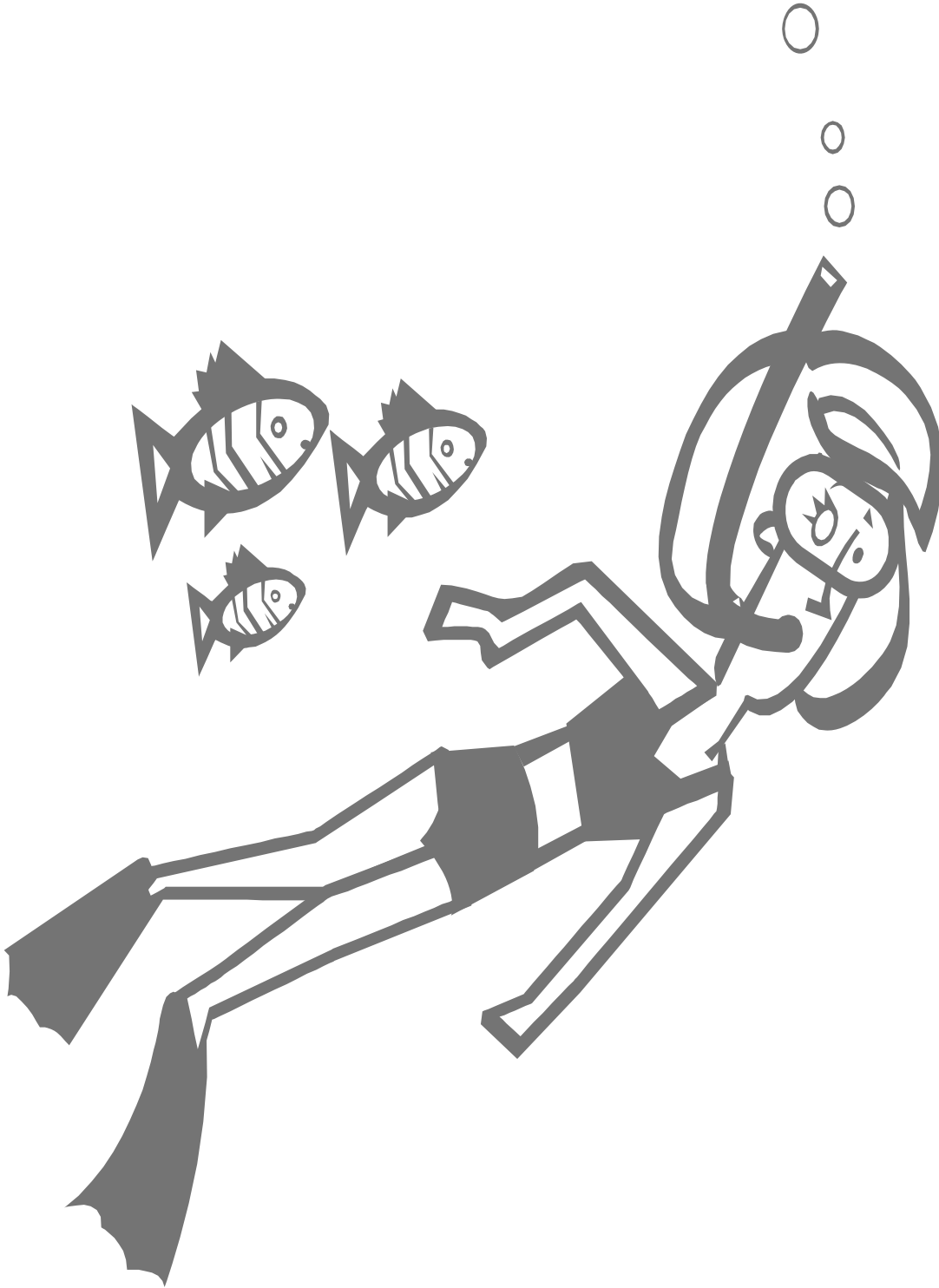
Size:

Temperature:

Age:

If you could live near any one of the five oceans which would you chose and why?

_____'s Water Log
Name



More than Enough - Table

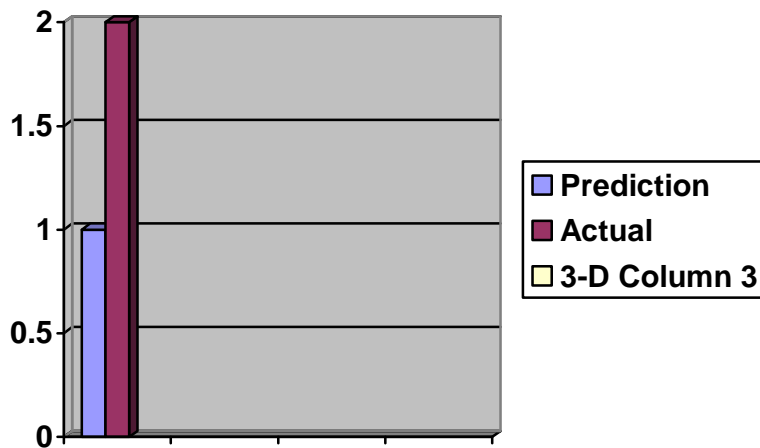


Student	Number of Coins Prediction	Number of Coins Actual
Student #1		
Student #2		
Student #3		
Student #4		

MORE THAN ENOUGH

STUDENT WORK SHEET

NAME _____ DATE _____



EXAMPLE

Directions: Make a double bar graphs showing prediction and actual data from the class experiment. Use graph paper label x and y-axis.

